

# ***AUTOMATED FORGING LINE FOR CRANKSHAFT***



## LINE TECHNICAL DATA

- 7000 T NKMZ forging press
- 1000 T trimming press
- 5 robots ABB
- Spray system
- Quick die changing
- Production speed per hour : 266...300

## EDITORIAL

**"A**utomotive industry is requiring from forger to install faster and faster forging production capacities. This expectation is pushing a lot of forging company around the world to design their new and retrofit lines in order to reach the target of excellence, speed, quality and reliability .

**EAST ENGINEERING**, as your partner, works with the most famous partners in order to invent, design, build, deliver to you and erect forging solution for your company in respect of these requirements.

Let us introduce you a standard solution for automated forging of crankshafts, based on our experience with one of the most famous company in North America, working for General Motors in the United States.

We hope this paper will meet your expectations. We would be pleased to meet you ! //



**Luc BASSETTE**  
Project manager

## Line technical characteristics

The line includes :

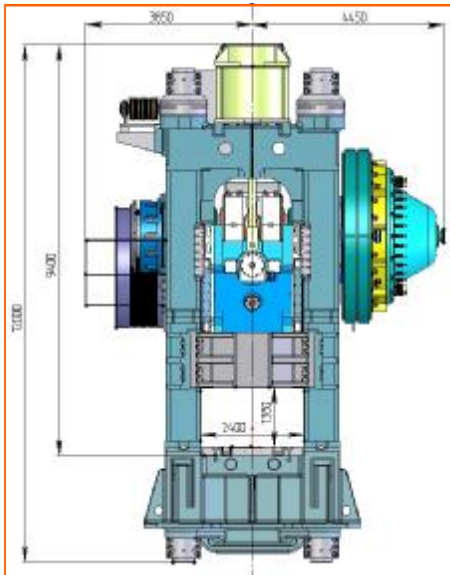
- 7000 T forging press from NKMZ (Ukraine). This press was especially built for forging of crankshaft : Large table allowing to install 4 stations on the bed, large shut height, large side windows, high rigidity (1700 t/mm).
- 1000 T trimming press from TMP (Russia) - Standard model
- 1 central panel desk for management of the whole line from only one location ;
- 4 robots ABB 175 KG—Foundry protection
- 1 robot ABB 225 Kg—Foundry protection
- 1 double head spray system manipulator from JERKO Spruehsystem®. This manipulator is able to clean, cool and lubricate in 3.8 s (included time to move to the press and to move back— effective time for lubrication: 1.2—2 s)
- 1 quick die changing for cassettes—SERAPID
- 1 induction heater—SMS ELOTHERM \*
- 1 control cooling—NUTEC \*

\* Not included in our delivery

## NKMZ 7000 T FORGING PRESS

### General characteristics

- Two rods for best supporting of any hard eccentric efforts
- Adjustment of the distance between table and ram
- Very great high rigidity of the frame (assembly by 4 hydraulically compressed tie rods)
- centralized lubrication by recycled oil circulation (eccentric shaft, rods and bearings principal, etc.)
- 3 Independent ejectors in special additional plate designed especially for the project
- Temperature measurement of the main machine mobile parts (rods, bearings, slides, etc.)
- Control effort device of forging and safety against the overloads, by piezoelectric sensors and display system.
- Electronics components of assistance to the adjustment, operation and maintenance.
- Sound-proofing and hooding of safety.
- Device of releasing of the slide by four hydraulic screws placed on the tie rods.



### FRAME

It is carried out of strong sections sheet steels, cut out and welded. It consists of three principal parts: Table, columns and top cross.

The welded parts undergo a thermal stabilizing treatment eliminating all internal tensions before machining. An ultrasonic control guarantees the perfect execution of the unit. The frame and the table are keyed and assembled by four forged steel ties. The amounts thus work only under the compression of the ties which are compressed using a hydraulic device (description hereafter).

The frame comprises the slides of ram guiding. The front slides are prolonged upwards, which makes it possible to ensure guidance in the capital of the press.

This design increases in a significant way the length of the slide guiding and admits efforts offset without harming the correct operation.

### ECCENTRIC SHAFT

It is carried out of nickel steel chromium plates molybdenum, forged and treated largely dimensioned and machined with the highest degree of accuracy. It is conceived to resist significant overloads and turns in bronze rings fixed in the principal stages which are maintained in the frame using conical rings.



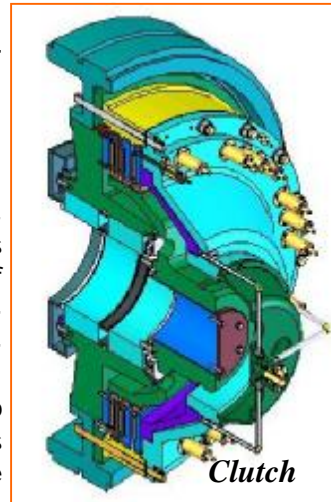
The design of this shaft with its crank pins of very large diameter and its significant rays of junction, allows by its rigidity, to guarantee a constant precision of the forgings. The axial loads are absorbed by a thrust comprising a

bronze ring.

The heating of the stages is controlled permanently by thermal probes.

### CLUTCH

The clutch is of the type with friction, with electro-pneumatic order. It is installed on the toothed wheel itself assembled on automatically lubricated bearings. The clutch, calculated with raised safety coefficients, transmits the torque of the order to the eccentric shaft and guarantees a reliable operation and intensive using.



### BRAKE

The brake is with friction, with 3 discs. The function is provided by action of the springs at the time of the exhaust of air.

The oversize brake, ensures of the precise stops. The electro pneumatic control device of the clutch and the brake authorizes the clutch only after the complete elimination of the brake, which prohibits any simultaneous operation of the clutch and the brake. The cooling of the brake is performed by water circulation.

### RAM AND RODS

The ram is carried out of casting steel of the first quality and with double guidance of precision (see above).

Openings are envisaged giving access for the factory inspectorate, in general, like for the tightening of the bolts of the connecting rod caps.

The faces of the ram are machined and scraped. They slide

on bronze plugs fixed at the slides of the frame.

The eight slide guides, are adjustable.

The ram comprises positive ejectors downwards allowing the ejection of the parts. The ordering of the ejection is performed by hydraulic cylinder.

The ram also have a new system of adjustment.

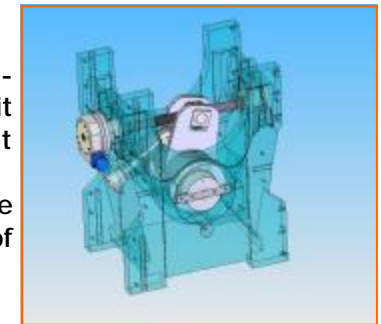
The two connecting rods are carried out of steel of high quality, and are largely dimensioned. Boring is provided with two special bronze half bearings.

The large 2 connecting rods increases the eccentricity of the effort capacity, allowing to install up to 4 forging stations in the press.

### RAM ADJUSTMENT

The mechanism of ram adjustment is located in the ram itself, it is activated by an independent electric or hydraulic motor.

The system comprises a torque limiter preventing any risk of overload of the engine.



### EJECTORS

The upper and lower ejectors are independent and hydraulically-operated.

### SYSTEM OF LUBRICATION

All the principal sets of the press (eccentric shaft, rods, bearings principal) are lubricated starting from the centralized automatic system of oil circulation.

The press comprises two circuits of lubrication:

- 1) automatic centralized lubrication, with oil for secondary eccentric shaft, rods, slide, gears, bearings of clutch.
- 2) automatic centralized lubrication, with grease for slide guides, ram, lower ejector and higher ejector.

## 7000 T technical data

SPECIFICATIONS	
Capacity	7 000 KN
Stroke	460 mm
continuing stroke pulse	40 s/mn
stroke by stroke pulse	12 s/mn
Ram adjustment	10 mm
Shut height	1500 mm
<b>Table dimension</b>	
Left to right	2400 mm
Front to Back	2000 mm
<b>Ram dimension</b>	
Left to right	1900 mm
Front to Back	1850 mm
<b>Side Window</b>	
Width	1250 mm
Height	1760 mm
<b>Upper ejectors</b>	
Number	3x2
Distance between centerline	350x290 mm
stroke	40 mm
Capacity	510 KN
Diameter	50 mm
<b>Lower ejectors</b>	
Speed to move up	100 mm/s
speed to move down	100 mm/s
Number	3x2
Distance between centerline	350x290 mm
stroke	95 mm
Force totale	1000 KN
Diamètre d'éjecteurs	70 mm
<b>Main motor</b>	
Power	400 KW
speed	600 t/mn
<b>Ram adjustment</b>	
Power	3 KW
speed	1200 t/mn
<b>Overall dimension</b>	
Left to right	9640 mm
Front to Back	6350 mm
Height from floor level	9780 mm
Weight	693 tonnes
Rigidity	1700t/mm

## AUTOMATION

Automation project is performed by DIC TECHNOLOGY (France—member of East Engineering Group), which is a very high specialized in automation for automotive industry and forging process company.

The line is automated with 5 robots ABB, basically :

- 1 robot to load the main press ;
- 2 robots for transferring ;
- 1 robot to trim
- 1 robot for coining operation (if necessary) and to extract from the 1000 T the flash and the part.

The speed rate capacity of the line is up to 266 crankshafts produced per hour ; But with smaller parts, 300 parts per hour could be expected.





Robot implant allows a very high flexibility, able to perform forging of different kind of parts and different processes (4 stations, 5 stations, rotation of the part, manual mode, semi-manual mode...).

The process is managed from only one central panel desk which receive every information hardware and software from each equipment of the line: induction heater, presses, spray equipment, quick die changing, control cooling conveyor communicate with the central panel desk.

It's very useful to receive at this stage process information and every failure message including the failure process information.

Of course, in manual mode, each press has also it's own command desk, for the operator.

Each electrical equipment of the line has been developed with same language to facilitate the software communication.

Grippers are especially designed for intense temperature, coming from the forging process. Frame and fingers are carried out in Inox steel and aluminum, auto-lubricated axles for movement were chosen. Only finger inserts have to be removed in case of change of production, allowing a very fast and easy production changing process.



## SPRAY MANIPULATOR—JERKO

Cleaning, cooling and lubrication of dies don't have to penalize in any manner the time diagram of the line. Also, with such speed (300 parts/hour), it's necessary to spray pre-forming and forming dies, and to cool also the bending die. So, we have designed with JERKO SPRUEHSYSTEM® a special fast double head spray manipulator, able to spray two dies in the same time with the exceptional average timing of 1.8 s (adjustable between 1.2 to 2.00s) !



Manipulator speed (to go in the press and to move back) is also optimized by special high performance motor and slide guide.

Spray plate is designed specifically for each die to be lubricated. When there is a new part production, it's a piece of cake to change it. Spray system performs all most updated function like automatic refill, auto-cleaning, quick die changing, easy maintenance...



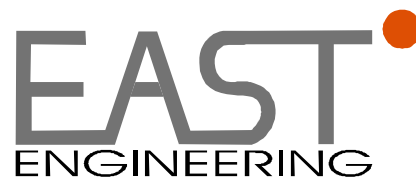
## QUICK DIE CHANGING—SERAPID

SERAPID Company is well known for quick die changing application in the industry.

Now for changing of dies into the bolster, it will takes less than 15 Mn !

Regarding to your process, the equipment should be a single, double or triple cart, able to change the whole bolster or only cassettes into the bolster.

Just ask the line to stop, prepare the next set of dies and go ahead for a very easy changing process.



***Just Contact and meet us !***

## DIE BOLSTER AND CASSETTES

Bolster and dies are the heart of the forging process. We will develop with you and your engineering department the most useful die bolster regarding of your parts and dies design

Our partners can guarantee to you a very High level quality steel making able to produce degassed steel blocks for your bolster.

X guides technology will insure a high level of precision during the process.

Our bolsters can be delivered with a complete set of die clamping, and have, if required, some special internal ejection system, regarding of your specific process.

We can propose also, if you have any interest, to use cassettes into the bolster to accelerate die changing with minimum of heavy manipulation.

